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UNITED STATES PUBLIC HEALTH SERVICE

RUPERT BLUE, SURGEON GENERAL

FIELD IDENTIFICATION OF MALARIA-
CARRYING MOSQUITOES

BY

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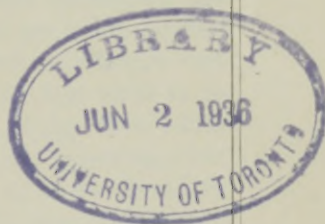
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FIELD IDENTIFICATION OF MALARIA-CARRYING MOSQUITOES.

As the transmission of malaria from one individual to another is effected through the exclusive agency of *Anopheles* mosquitoes, it is desirable that data for the field identification of the commoner of these insects be available to health officers and others concerned. The following schematic outline has been prepared with the idea of affording untrained observers a ready means of identification. For use in the field a small hand lens, magnifying from two to four diameters, is of service, although not essential.

Mosquitoes are distinguished from other similar appearing insects by the fringe of scales along the posterior border of their single pair of wings, the wing veins being also fringed with scales. If the insect in hand lacks the posterior fringe of scales it does not belong

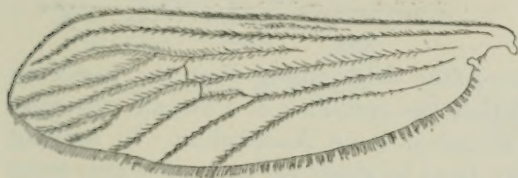


FIG. 1.—Wing of *Culex pungens*—Berkeley, 1902, Laboratory work with mosquitoes, p. 35, Fig. 27.

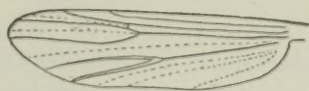


FIG. 2.—Wing of Diptera mistaken for mosquito—F. V. Theobald, Vol. 1, 1901, p. 92, Fig. 23.

to the mosquito family, however much it may resemble that insect in appearance. There are three families of insects, the sand flies, the crane flies, and the midge flies, which may be confused with mosquitoes, but ordinarily the health officer will encounter little difficulty in making the differentiation even without examining the wing structure. The sand flies of the United States are much smaller in size than mosquitoes, while the crane flies are not only larger, but the body is long and slender and the length of the legs such as to be out of proportion even to that of the body. Midge flies, often called "midges," are usually seen in dancing clouds hovering over one's head in the late afternoon, and nearly all of those found in this country lack the long proboscis or biting part, have bare wings, and are more delicate than mosquitoes.

Some species of *Anopheles* mosquitoes may fly a mile or more, but such long flights are unusual. Other varieties of mosquitoes are frequently carried several miles by the wind, but visitations of insects in this manner are not followed by outbreaks of malaria, as the insects are never *Anophelines*. The mosquito can not infect a person with malaria until at least eight days after it has bitten an individual with the malarial parasite in his blood, but once a mosquito is infected she probably remains so throughout life. Mosquitoes may

live five or more months. The life cycle of the *Anopheles* mosquito includes four stages, the first three of which (egg, larva, and pupa) are invariably passed in water.

Determination of sex.—Only the female bites, and for this reason it is essential that the sexes be differentiated. Fortunately this can be easily accomplished.

MALE.

Antennæ, of all varieties, markedly plumose, i. e., "heavily haired."



FIG. 3.—Head of *Anopheles*—male.

FEMALE.

Antennæ, of all varieties, not plumose, i. e., "sparsely haired."



FIG. 4.—Head of *Anopheles*—female.

Determination of genus.—After determining that the insect in question is a mosquito and that the specimen is a female, the next step is to decide whether or not it is an *Anopheline*. In making this decision there are many facts to guide us, each of which must be considered in its turn. For the purpose of comparison the most common variety of mosquito, the *Culex*, is selected and the differences throughout the various stages of development, beginning with the egg, noted.

Eggs.

ANOPHELES.

The eggs are laid singly, and for this reason are seldom found in nature. They float on the surface of the water and are supported by lateral air spaces.



FIG. 5.—Ova—*Anopheles*.

CULEX.

The eggs are laid in rafts or boat-like masses of about 200 and are readily visible to the naked eye. Instead of floating on the side they are arranged vertically. There are no lateral air spaces.



FIG. 6.—Egg raft. *Culex*.

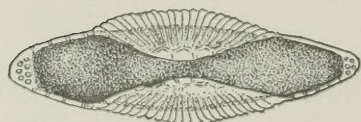


FIG. 7.—Egg—*Anopheles maculipennis*.



FIG. 8.—Egg of *Culex*.

Larvæ.

ANOPHELES.

The larvæ lie at the top of the water and parallel to the surface, as Carter so aptly expresses it, "for all the world like a basking pike." The head is much smaller than the thorax. There is no respiratory siphon. Upon being frightened the larvæ may dive, but usually they dart parallel to the surface.

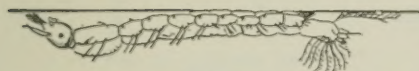


FIG. 9.—Larva of Anopheles.

CULEX.

The larvæ hang head downward from the surface of the water at an angle of about 60°. The head is much larger than the thorax. There is a long respiratory siphon at the tail. Upon being frightened the larvæ usually dart downward.

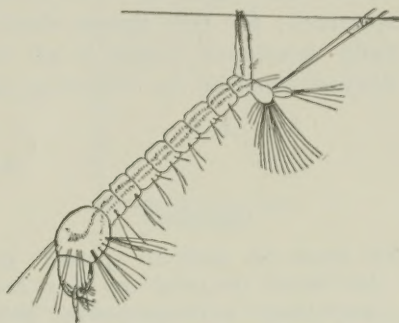


FIG. 10.—Larva of Culex.

Pupæ.

ANOPHELES.

The pupæ are larger in the antero-posterior direction and narrow laterally. The respiratory siphons are short and trumpet like, the small end being attached near the middle of the thorax.



FIG. 11.—*Anopheles punctipennis*—Say. (Mosquitoes of N. America, Vol. 2, 1912, Howard, Dyar, and Knob plates.)

CULEX.

The pupæ are shorter and broader from side to side. The respiratory siphons are long, narrow, and tube like and are attached near the posterior end of the thorax.

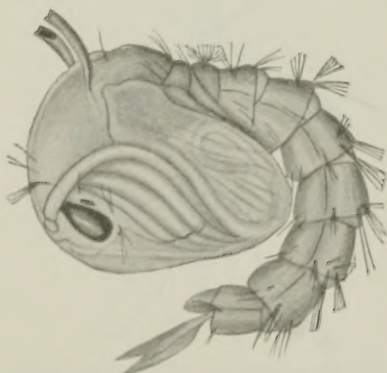


FIG. 12.—*Culex pipiens*—Linnaeus. (Mosquitoes of N. America, Vol. 2, 1912, Howard, Dyar, and Knob plates.)

It should be borne in mind in searching for larvæ that they are remarkably shy, and for this reason it may be necessary for the examiner to wait over the pool for some little time in order that they may come to the surface after their disappearance. Should the observer encounter difficulty in determining the genus of the aquatic forms he should remove the larger larvæ or pupæ from the pool and allow them to hatch under artificial conditions, in this way obtaining the adult insect for additional guidance. While the larval characteristics are thoroughly dependable in the determination of the *Anopheles* genus, the health officer will naturally be called upon more often to make the identification from the adult specimen; for this reason familiarity with the appearance of the fully developed insect is all important. Adult Anophelines are distinguished by the following characteristics:

Adults.

ANOPHELES.

The wings are distinctly spotted. In the female the palpi are about the same length as the proboscis. This is true in no other mosquito except one, which happens to have a curved proboscis. Therefore, if the specimen is a female and if the palpi are nearly as long as the straight proboscis the insect is an *Anopheles*.

CULEX.

The wings are not spotted. In the female the palpi are much shorter than the proboscis.

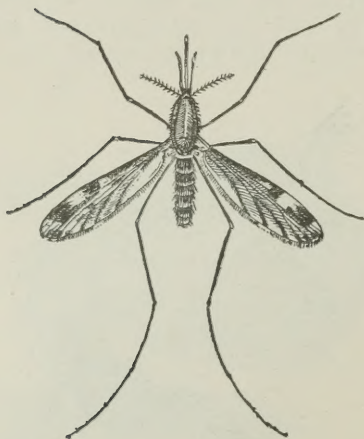


FIG. 13.—*Anopheles punctipennis*, female.



FIG. 14.—*Culex pipiens*, female.

When resting or biting the proboscis, head, thorax, and abdomen form one straight line.

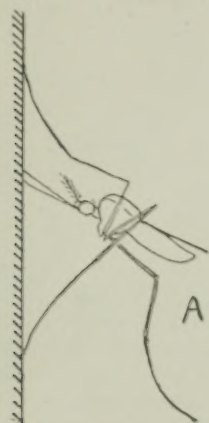


FIG. 15.—Resting position—Anopheles.

When resting or biting the insect is "humpbacked"; head and abdomen are down, thorax is up.

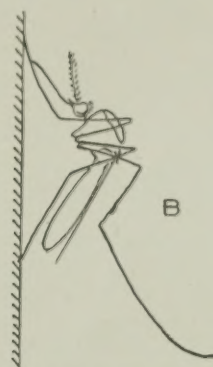


FIG. 16.—Resting position—Culex.

Habits.

ANOPHELES.

The Anopheles mosquito is far less annoying than the Culex. It seldom bites in the daytime and does not often attack a person moving about. The bite is also less painful. The hum of the insect is not as distinct as that of the Culex. Anophelines prefer to breed in cleaner water than do the Culicines.

CULEX.

The Culex mosquito is distinctly annoying. It bites at all times and is not shy, as is the Anopheles. The bite is irritating. The hum is particularly loud. Culicines are less particular concerning the character of the water in which they breed than are the Anophelines.

Three Anophelines occur commonly in the United States. All have been proven to be transmitters of malaria. They may be distinguished by their wing markings as follows:

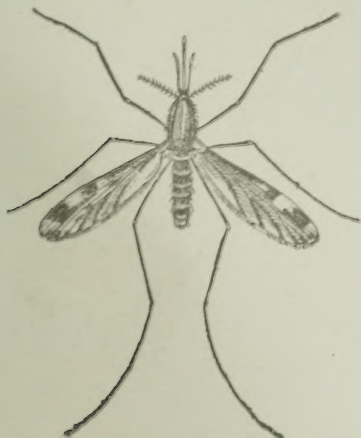


FIG. 17.—Anopheles punctipennis, female.

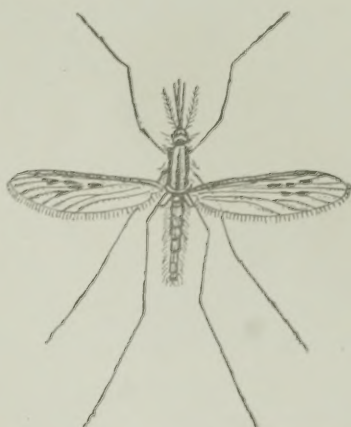


FIG. 18.—Anopheles quadrimaculatus, female.

Anopheles punctipennis.—A large square or oblong white or yellowish patch at the anterior margin of the wings near the outer end is the striking characteristic. This patch of white is readily visible to the naked eye and is easily seen even when the insect is in the resting position with the wings crossed. After determining that the insect is a female *Anopheles* this patch of white should be looked for; if not found the specimen is sure not to be a *punctipennis*. The anterior margin of the wing is dark, while the balance is lightly spotted or mottled with black, with an almost invisible white spot at the extreme apex. Besides breeding in quiet waters *A. punctipennis* is the only one of the three *Anophelines* which breeds in running water and streams which are subject to freshet from rains. This particular insect is more often found on porches, in outbuildings, and under houses than within habitations.

Anopheles quadrimaculatus (*maculipennis*).—Three to five, but usually four, black spots (patches of black scales) on the second and fourth wing veins. Breeds more often in quiet waters, pools, etc., and invades human habitations.

Anopheles crucians.—The wing is dusky and the veins are prominently marked. The characteristic marks are three small spots of black on the sixth wing vein (thoracic end, posterior margin). In the young insect the spots are apt to be distinct, but if the specimen is old the end spot is usually missing.

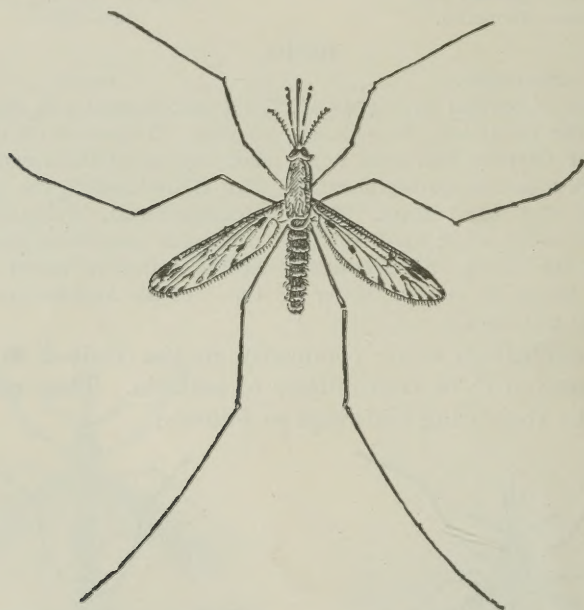


FIG. 19.—*Anopheles crucians*, female.